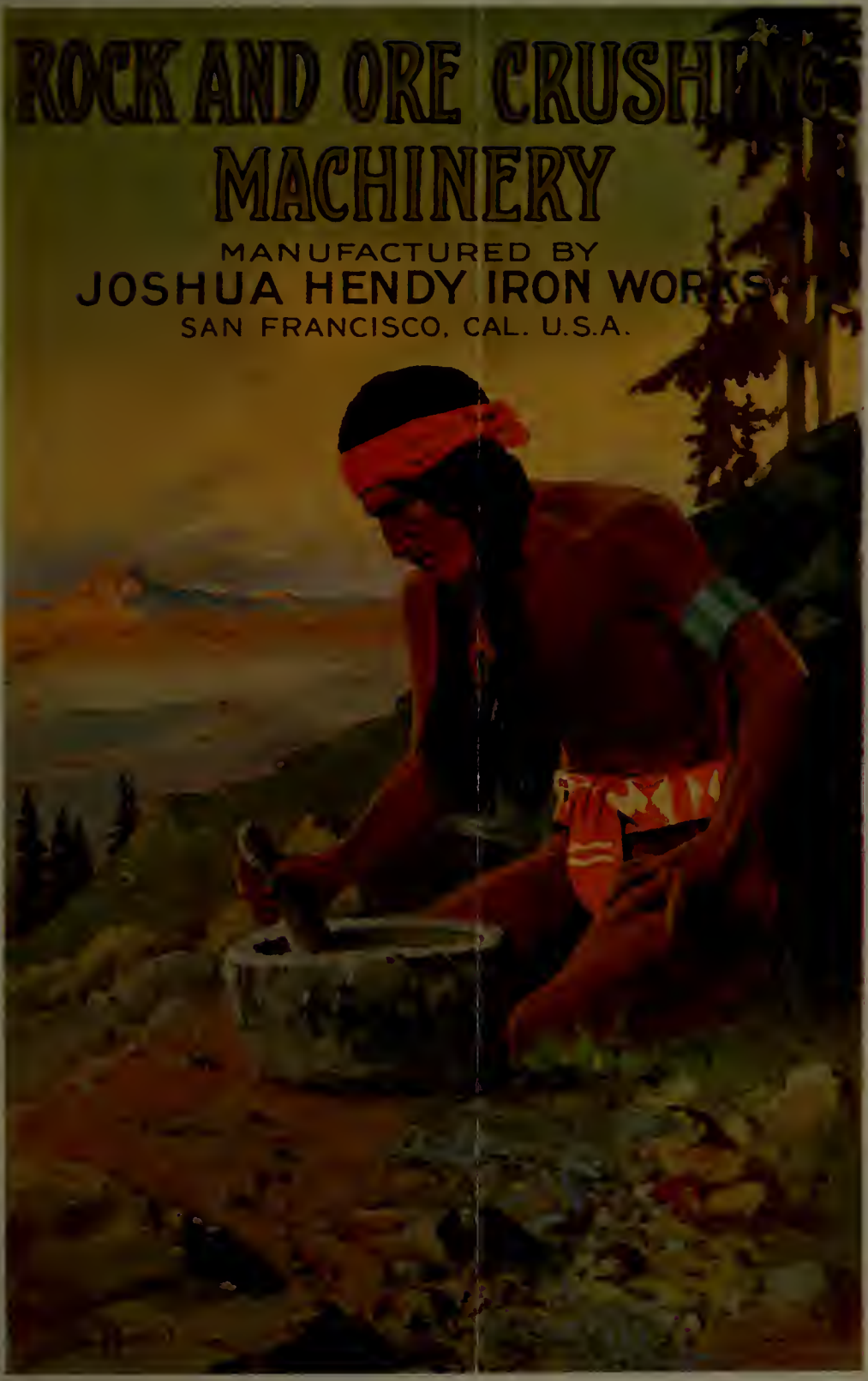
# ROCK AND ORE CRUSHING MACHINERY

MANUFACTURED BY

JOSHUA HENDY IRON WORKS

SAN FRANCISCO, CAL. U.S.A.



Rockbreaking Methods in Vogue in 1560 A. D. From Old Print

ROCK Breakers or Crushers as a rule constitute the first step in the treatment of ore in milling and reduction plants. Two types of rock crushers are in universal use,—the standard rectangular jaw crusher, and the cylindrical or gyratory crusher. Both crushers act upon the principle of approaching and receding jaws which deliver crushing blows upon the material to be broken, and both types have their advantages on certain classes of material. They are fed with ore of mixed sizes up to the maximum diameter that the mouth or receiving opening can take, and they break it to a fairly uniform size, which latter is determined by the distance between the jaws, or the throat of the discharge opening. As the large size and irregularity of the rock generally precludes automatic feeding, feeding is done by hand or by shovel, in many cases by sloping chute from the bottom of a bin, the attendant easily pulling forward the ore in the chute with a rake or a tool made for the purpose.

Standard practice has demonstrated beyond question the general advantage and superiority of the jaw type of crusher over the gyratory crusher for general work—the latter while possessing many practical features, has been universally replaced by jaw crushers, except in plants where the material to be crushed is uniform in size, and of a texture especially adapted to the gyratory principle.

The breakers referred to in this bulletin are all of the intermittent or jaw type and of our own manufacture, and are illustrated and described in the following order:—Hercules-Blake, Dodge, Roll-jaw, and the Hutchinson.

The Blake breaker in its original form was first patented in 1858, and was the first successful breaker of the jaw type, and it has held its place as the standard machine ever since, being manufactured by builders of mining machinery throughout the world, with various improvements, but still retaining the basic ideas of the early invention. The principle of the operation of this breaker is too well known to require a lengthy description: however, it may be said that it has the least movement and consequently the greatest leverage at the throat where the largest particles of rock are broken and consequently is capable of doing a greater amount of work with less consumption of power per ton of ore crushed than any other jaw breaker. The greatest movement of the jaw is at the discharge end, therefore an easy and free discharge of the crushed rock is permitted, for this same reason and also because the lower end of the jaw when opening is apt to allow larger pieces to occasionally drop through, a finely crushed and even sized product is not obtainable.

The Dodge breaker on the contrary has the greatest movement at the throat where the largest particles of rock are broken and consequently exerts the least leverage where it has the hardest work to perform. This breaker, therefore, is not adapted to heavy work, and it does not have as large a capacity per HP as the Blake. Being essentially a fine crusher it produces a fine and even product owing to the fact that the jaws at the discharge end are fixed and do not permit large particles of rock to leave the jaws as in the case with the Blake breakers.

The Roller Jaw breaker differs from either the Blake or Dodge breakers in that it is designed to handle a class of material that can not be economically broken by the first named machines. The Roller jaw breaker is essentially designed for breaking or crushing wet or sticky ores of a clay or talc character, being the only successful breaker on the market for this purpose. The movement of the jaw given by the eccentric shaft and the toggle produces at once a combined downward and forward movement, the roller being revolved with the material as it is fed and crushed between the die or roller and the shoe on its way to the discharge end. Reference is made to page 14 for additional information.

The Hutchinson breaker illustrated on page 18 has an original and new movement of the shoe and die producing an effect not found in any other breaker, in that the combined downward and forward movement alternate in an opposed position, resulting in a combined crushing and grinding action on the rock fed to it, while at the same time causing a positive discharge of uniform product. As a fine breaker it is not equalled by the Dodge and is capable of larger tonnage in a given time with about the same consumption of power.

The succeeding pages of this bulletin are devoted to descriptive matter concerning crushing rolls and revolving screens and grizzlies of our own manufacture and embraced under the title of this publication.

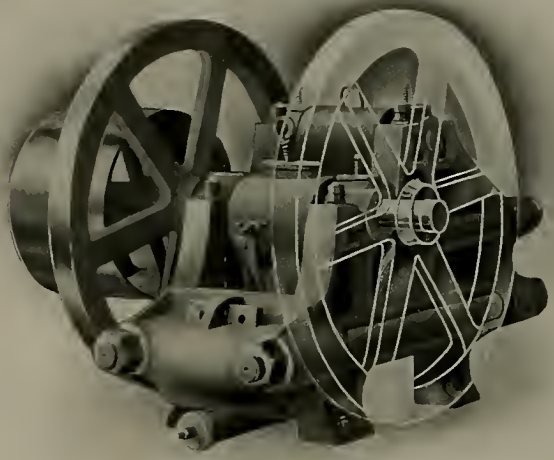
# The "Hercules-Blake" Rock or Ore Crusher

## (Type B)


The elementary principle of this machine is the same as has been in use for many years past, but a number of new and novel features have been added thereby greatly increasing its usefulness, and also placing it in a class distinctly superior to other Blake Crushers which have been heretofore offered by other manufacturers. One of the impovements is found in the toggle-plate made in two halves, lapped over one another and riveted together. (See page 9 for illustration). During the operation of crushing the rivets are in shear, and while the number of rivets used and their size are proportioned so as to be amply strong to withstand the strain of crushing hard quartz, yet in the event of any unusual obstruction, such as a sledge hammer finding its way into the crusher, the rivet heads will shear off, causing the toggle-plate to collapse, thereby permitting the obstruction to pass through without damage to the crusher. In the ordinary types of crushers damage occurs and frequently the front head, pitman or movable jaw yields to the strain and the breaker becomes useless. The replacement of toggles is inexpensive and a small item as compared with the renewal of the important other parts of the crusher.

A prime feature of these crushers is found in the **Adjustable Toggle-Seat** (see page 9) insuring an even bearing for the toggle at all times.

It will be noted from the illustrations that we have greatly increased the thickness of the back and front heads of this crusher as compared with our earlier types, likewise the side frames and also retaining the excellent principle of sustaining the strain of crushing by four heavy forged steel rods shrunk-in to the ends and securely held on the rear end by hexagon nuts.



End view of "Hercules-Blake" Crusher

A means for adjusting the space between the jaws for regulating the size of the output, as well as taking up the wear is provided by the use of sheet metal shims, behind the rear toggle block, and also by using **toggle plates** of various lengths.

The pitman is cast solid, as a cap at the crank-bearing is unsatisfactory. The adjustment for wear at this point is made by means of a gib and cotter-key with lock nuts and easily adjusted. The shoes and dies supplied on these breakers are of "Adamantine Chrome Steel" and are made reversible end for end, the economy of which is at once apparent. The fly wheels are held by saddle-keys and set screws which permits them to slip in case of a sudden stop.

The economy of any crusher depends on the hardness and friability of the material to be crushed, the fineness to which it is desired to crush and the speed. THE CAPACITIES GIVEN IN THE FOLLOWING TABLE ARE BASED UPON THE CRUSHING OF ORE OF MODERATE HARDNESS AND FRIABILITY containing no excess of moisture; the jaws being set to crush to 1" inches with the machine being set at its tabular speed when properly fed.

A ton is considered to contain 20 cu. ft. of ordinary broken quartz.

# "Hercules-Blake" Crushers
## (Type B)

### Specifications and Weights

| Size of Machine | No. | Size of Jaw Opening Inches | Tight and Loose Driving Pulleys | | | Capacity, per Hour in Tons | H. P. Required | Weight of Heaviest Piece | Total Weight | Extreme Dimensions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inches | | Rev. per Minute | | | | | Length | Width | Height above Base |
| | | | Diam. | Face | | | | Pounds | Pounds | | | |
| Baby | 1 | 6 x 7½ | 20 | 6½ | 275 | 3 | 4 | 310 | 2700 | 4′ 3″ | 3′ 11″ | 3′ 2″ |
| Junior | 2 | 7 x 9 | 22 | 6½ | 275 | 4 | 5 | 435 | 3500 | 4′ 3″ | 4′ 3″ | 3′ 6″ |
| Baby | 3 | 8 x 12 | 24 | 8½ | 250 | 6 | 8 | 600 | 5860 | 5′ 3″ | 4′ 9″ | 4′ 0 |
| Standard | 4 | 10 x 16 | 30 | 10½ | 225 | 10 | 12 | 1310 | 10200 | 6′ 0″ | 6′ 4″ | 4′ 11 |
| | 5 | 12 x 20 | See page 7 | | | | | | | | | |
| | 6 | 14 x 24 | | | | | | | | | | |

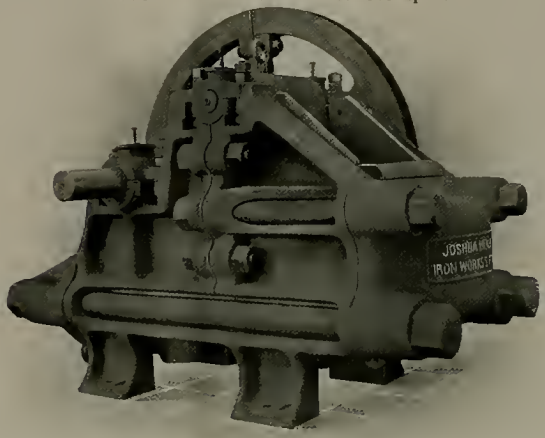
N. B.—Crushers numbers 5 and 6 have movable jaw, pitman and front and rear heads made of cast steel, and are designed for exceptionally heavy duty (see page 7).

Illustration showing Hercules-Blake Crushers in Warehouse at the Stanley Works of Joshua Hendy Iron Works

JOSHUA HENDY IRON WORKS
SAN FRANCISCO, CAL. U.S.A.

# "Hercules-Blake" (Type B) Ore or Rock Crusher

## Made Sectional for Animal Transport



Side illustration of sectional "Hercules-Blake" Crusher with one flywheel and tight and loose pulleys removed

| Code Word | No. | Size of Jaw Opening Inches | Tight and Loose Driving Pulleys | | | Capacity per Hour in Tons | H. P. Required | Weight of Heaviest Piece | Total Weight | Extreme Dimensions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inches | | Rev. per Minute | | | | | Length | Width | Height above Base |
| | | | Diam. | Face | | | | Pounds | Pounds | | | |
| Ebeni . . . | 1 | 6 x 7½ | 20 | 6½ | 275 | 3 | 4 | 310 | 2700 | 4′ 3″ | 3′ 11″ | 3′ 2″ |
| Ebenus . . | 2 | 7 x 9 | 22 | 6½ | 275 | 4 | 5 | 285 | 3635 | 4′ 3″ | 4′ 3″ | 3′ 6″ |
| Ebeto . . . | 3 | 8 x 12 | 24 | 8½ | 250 | 6 | 8 | 407 | 6545 | 5′ 3″ | 4′ 9″ | 4′ 0″ |

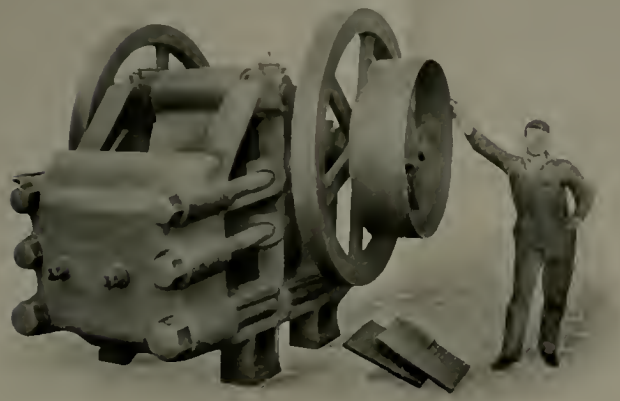
In designing crusher sections, not to exceed 300 lbs. each, we have developed 3 sizes as above noted with the following exceptions:—On the 8 in. by 12 in. crusher the front and rear heads weigh 407 and 381 lbs. respectively, two side frame sections 350 lbs. each, and two 315 lbs. each. Four sections of the two fly wheels 305 lbs. each.

Side and end view "Hercules-Blake" Crusher (sectional)

# "Hercules-Blake" Special Crusher

## (Type B)

### Built for extra heavy duty



A decade since when gyratory breakers were popular and in almost universal demand for use in the larger quartz mills and rock quarries of that period, the general impression held by most practical millmen presaged a limited use of the jaw breakers for the future.

After years of practical comparison and observation these opinions have been reversed and of recent years jaw crushers have again regained favor and in many instances preference. Jaw crushers are today performing duties where the gyratory breakers were absolute failures.

The Hercules-Blake "Special" Type B Crusher will disintegrate rock which cannot be handled in the ordinary jaw breaker. Granite boulders round smooth cobbles, hornblende-granite and the like yield easily to the power of this special breaker supplied as it is with steel pitman, cheek plate front and rear head and toggle seat. The shoe and die are either of "Adamantine" Chrome steel or of Manganese steel (see page 8 for further description). The crushing strain is carried by 6 hammered steel tension rods. Rated capacity is based on crushing to 2½ in. ring size.

| Code Word | No. | Size of Jaw Opening Inches | Tight and Loose Driving Pulleys | | | Capacity per Hour in Tons | H. P. Required | Weight of Heaviest Piece | Total Weight | Dimensions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inches | | | | | | | | | |
| | | | Diam. | Face | Rev. per Minute | | | Pounds | Pounds | Length | Width | Height |
| Ebben | 5 | 12 x 20 | 36 | 12½ | 225 | 18 | 20 | 1675 | 16600 | 6′ 11″ | 7′ 8″ | 5′ 6 |
| Ebbar | 6 | 14 x 24 | 42 | 12½ | 225 | 25 | 28 | 3000 | 26000 | 8′ 4″ | 7′ 9″ | 6′ 11 |

## Some advantages found in Hercules-Blake Crushers

In the illustration on the opposite page is shown an interchangeable, interlocking, sectional crusher shoe and die which was designed to obviate one of the most serious objections heretofore found in jaw type crushers, viz.: the waste of material in the solid type of shoe and die when only the portion worn required replacement. To better elucidate this paragraph, we have prepared the following engravings.

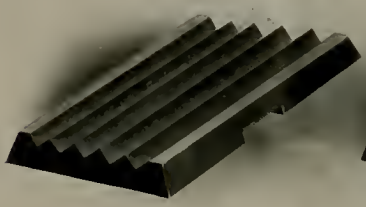


Fig. 1

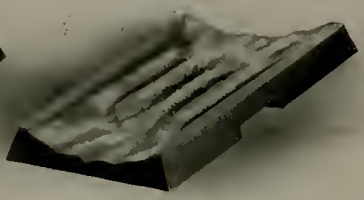
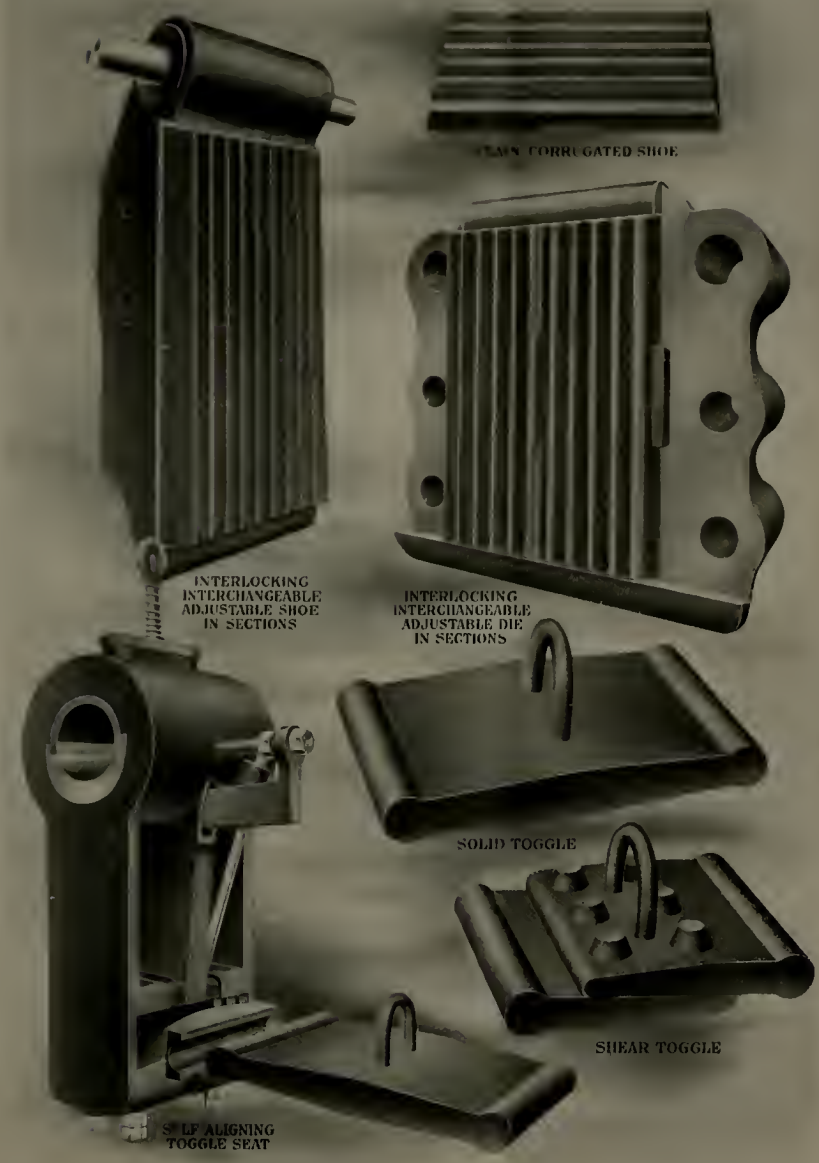


Fig. 2

Fig. 1 represents a new shoe or die of an older type of Blake breaker, and Fig. 2 a similar casting worn down and cupped so deep that large pieces of ore or rock are permitted to escape further crushing. As the wear is greatest in the middle ends of the surface, and not throughout the entire width, the worn shoe and the die may be set up until they practically touch at the edges, and still be so badly worn or cupped that a piece of rock much too large for its purpose will easily escape and destroy the usefulness of the breaker. The average wear of shoes and dies is 25 per cent of the total weight when new, thus leaving 75 per cent to become discarded and of no further value. This defect does not occur in the interchangeable, interlocking, sectional shoes and dies. These are made in six sections, two upper, two middle and two lower. Being fitted and dovetailed together so that when the two countersunk head bolts through the middle sections are tightened, the whole six sections are securely interlocked in place. The two upper, as well as the two lower sections are interchangeable, being exactly alike, and these may be shifted, reversed and turned upside down as they become worn, until their usefulness is over. The two middle sections are interchangeable and may also be changed as becomes necessary, and worn almost entirely to the surface. Having briefly described this improvement, it will readily be observed that 85 per cent of the weight of the shoe and die can be used before replacements become necessary.

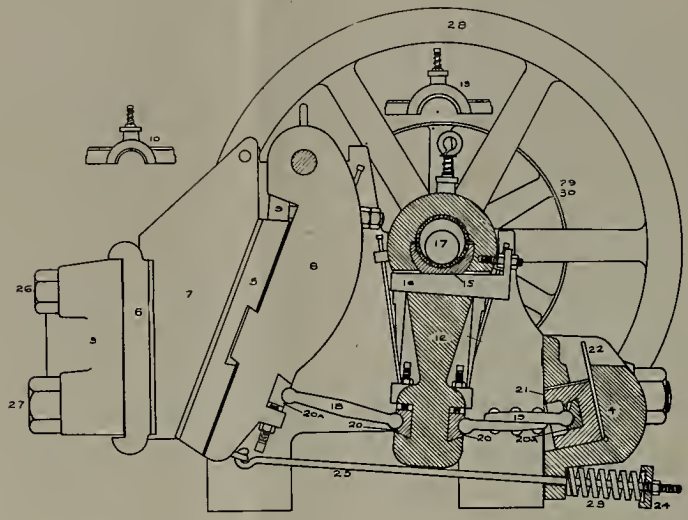
## Self-aligning Toggle Seats and Plates

The breakage of ordinary square toggle plates is due to the fact that it is practically impossible to make them bear evenly against the seats throughout their entire width. The unequal shrinkage of the frame castings, etc., cause the toggle plates to bear at one or two points only, the result being broken plates and a consequent loss of time and money. As will be seen from the illustration on page 9, the Hendy self-aligning toggle seats are laid out on the arc of a circle, the plates being made to suit. The ends and grooves are ground true, so that they bear throughout their entire length and automatically compensate for any unequal shrinkage or change in alignment of crusher frame.


STEAM CORRUGATED SHOE
INTERLOCKING INTERCHANGEABLE ADJUSTABLE SHOE IN SECTIONS
INTERLOCKING INTERCHANGEABLE ADJUSTABLE DIE IN SECTIONS
SOLID TOGGLE
SHEAR TOGGLE
SELF ALIGNING TOGGLE SEAT

Key for ordering duplicate parts of Type "B" HERCULES-BLAKE Crushers.

NOTE.—When ordering always give size of crusher and indicate by number of part required.




This list applies to crushers sizes 1, 2, 3, 4 only

1 Side frame (left hand)
2 Side frame (right hand)
3 Front end plate
4 Back end plate
5 Shoe
6 Die
7 Side plate (left hand)
7 A Side plate (right hand)
8 Swinging jaw with shaft
9 Bolts for holding shoe
10 Cap for bearing to swing jaw
11 Bolts for bearing to swing jaw
12 Pitman
13 Cap for bearing to pitman
14 Bolts for bearing to pitman
15 Half bearing for pitman
16 Wedge for half bearing
17 Eccentric shaft for pitman
18 Solid toggle
19 Riveted toggle
20 Toggle seats for pitman
20A Toggle seats for thrust block
21 Thrust block
22 Adjusting plates
23 Spring for swing jaw
24 Spring seat
25 Rod to spring
26 Upper tie rod
27 Lower tie rod
28 Fly wheel
29 Tight pulley
30 Loose pulley.

List of duplicate parts of HERCULES-BLAKE Crushers (Type B), sizes 5, 6, 7. While no sectional illustration of these crushers is shown on this page most of the parts are to be found in the line engraving on page 10 opposite, this list differing in detail only.

1 Side frame (left hand)
2 Side frame (right hand)
3 Front end plate
4 Back end plate
5.A Central section shoe
5B Top and bottom section shoe
6.A Central section die
6B Top and bottom section die
7 Side plate (left hand)
7.A Side plate (right hand)
8 Swinging jaw, with shaft
9 Bolts for holding shoe
10.A Right hand cap bearing to swinging jaw
10B Left hand cap bearing to swinging jaw
11 Bolts for bearing to swinging jaw
12 Pitman
13.A Right hand cap bearing to pitman
13B Left hand cap bearing to pitman
14 Bolts for bearing to pitman
15 Half bearing for pitman
16 Wedge for half bearing to pitman
17 Eccentric shaft
18 Solid toggle (give length)
19 Riveted toggle (give length)
20 Toggle seats for pitman
20.A Toggle seats for thrust block and swinging jaw
21 Thrust block
22 Adjusting plates
23 Spring for swinging jaw
24 Spring seat
25 Rod to spring
26 Upper tie rod
27 Lower tie rod
28 Fly wheel
29 Tight pulley
30 Loose pulley
31 Wedge block to No. 10
32 Bolt to wedge block No. 10
33 Bolts to shoe
34 Bolts to die
35 Bolt to spring rod
36 Center tie rod (14x24 in. only)
37 Pitman wearing shell

## The "Dodge" Ore and Rock Breaker


Made in three sizes

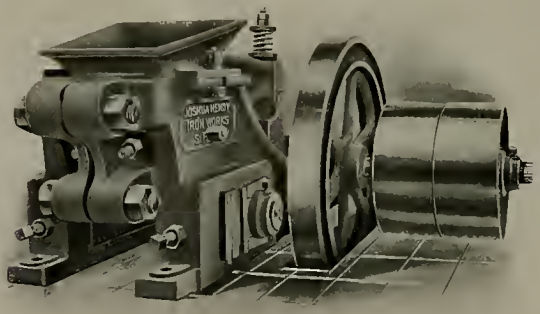
The "Dodge" type of ore breaker is intended to be used where a finer and more uniform product is desired. This is accomplished by its peculiar construction, the movable jaw being pivoted at the bottom, and giving the greatest throw at the top, and a motion hardly perceptible at the bottom. The size of product is determined by the distance apart between jaws, this is regulated by inserting packing blocks on either side of jaw shaft boxes and securing by adjusting screws.

The Hercules-Blake type is better adapted for large capacities and coarser crushing.

These breakers are fitted with steel shoes, dies and cheek plates; also tight and loose pulleys, of dimensions given. The rated capacity are based on 1½ in. jaw opening.

## The "Dodge" Ore and Rock Breaker

(Sectional for animal transport)




Made in two sizes only

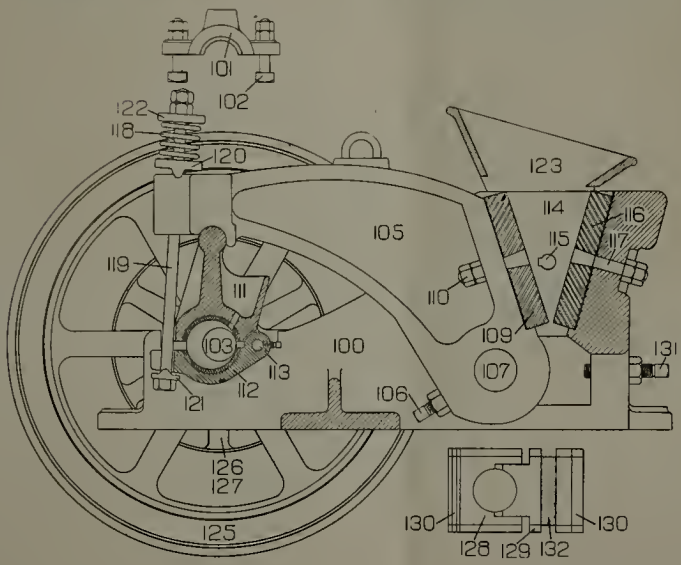
# Specifications for Dodge Crushers

| No. | Size of Jaw Opening Inches | Tight and Loose Driving Pulleys Diam. | Face | Rev. per Minute | Capacity per Hour in Tons | H. P. Required | Weight of Heaviest Piece Pounds | Total Weight Pounds | Dimensions Length | Width | Height |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 8 x 12 | 24 | 8 | 250 | 6 | 8 | 1400 | 4700 | 5' 2" | 5' 6" | 2' 0" |
| 2 | 7 x 8 | 16 | 6 | 300 | 4 | 6 | 665 | 2200 | 4' 4" | 4' 10" | 2' 0" |
| 3 | 6 x 7 | 16 | 6 | 350 | 2 | 4 | 545 | 1560 | 3' 8" | 4' 6" | 1' 11" |

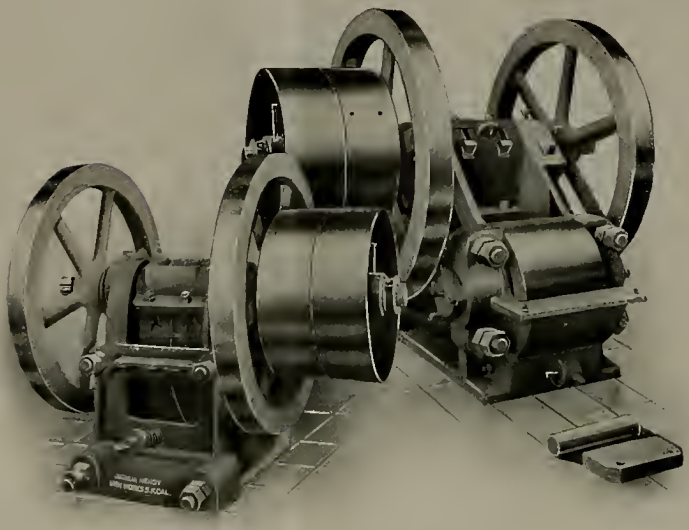
# Specifications for Dodge (Sectional) Crushers

| No. | Size of Jaw Opening Inches | Tight and Loose Driving Pulleys Diam. | Face | Rev. per Minute | Capacity per Hour in Tons | H. P. Required | Weight of Heaviest Piece Pounds | Total Weight Pounds | Dimensions Length | Width | Height |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 7 x 8 | 16 | 6 | 300 | 4 | 6 | 392 | 2400 | 4' 4" | 4' 10" | 2' 0" |
| 3 | 6 x 7 | 16 | 6 | 350 | 2 | 4 | 280 | 1625 | 4' 6" | 4' 6" | 1' 11" |

The heavy pieces on the No. 2 Sectional Crusher are: { 1 Sec. Frame 392 lbs. 1 Swinging Jaw 275 lbs. / 1 Sec. Frame 385 lbs. Other pieces under 165 lbs.




100 Frame
101 Eccentric Shaft Bearing Cap
102 Bolt for Shaft Bearing Cap
103 Eccentric Shaft
104 Safety Collar for Eccentric Shaft
105 Movable Jaw
106 Key and Bolt for Movable Jaw
107 Shaft for Movable Jaw
108 Safety Set Collar for Movable Jaw
109 Steel Shoe for Movable Jaw
110 Bolts for Steel Shoe for Movable Jaw
111 Toggle Plate
112 Cap for Toggle Plate
113 Pin and Set Screw for Toggle Plate
114 Side Liners
115 Bolts for Side Liners
116 Steel Die same as Shoe
117 Bolt for Steel Die
118 Spring
119 Rod for Spring
120 Seat for Spring
121 Cap for Spring Rod
122 Cap for Spring
123 Hopper
124 Bolts for Hopper
125 Fly Wheel
126 Tight Pulley
127 Loose Pulley
128 Fulcrum Bearing
129 Fulcrum Bearing Block
130 Filling Pieces
131 Adjustment Screw
132 Rubber Adjustment Pad



## "Roller" Jaw Crushers

The above illustrates our design and make of the "Roller" Jaw Crusher. The principal advantage of this type of crusher is its adaptability for working wet or sticky ores, or where fine crushing is desired. The movable jaw to which is attached the shoe is mounted upon a revolving eccentric shaft, which gives the movement to same. The ore being crushed between the shoe and revolving die, causes the die to make a slight forward movement at each stroke; a backward movement is prevented as the jaw ascends by a roller placed between the roll die and the frame. Arrangement is made for setting up shoe as it wears, or for fine crushing.

A scraper is also fitted so as to press against the entire width of roll, thereby cleaning same; the pressure against roll being regulated by lever and weight.

Double fly wheels are used, fitted with slipping keys; also tight and loose pulleys.

We manufacture the sizes given on following page. The prices are for crushers fitted with steel shoes and dies and steel cheek plates; also tight and loose pulleys as designated by list.

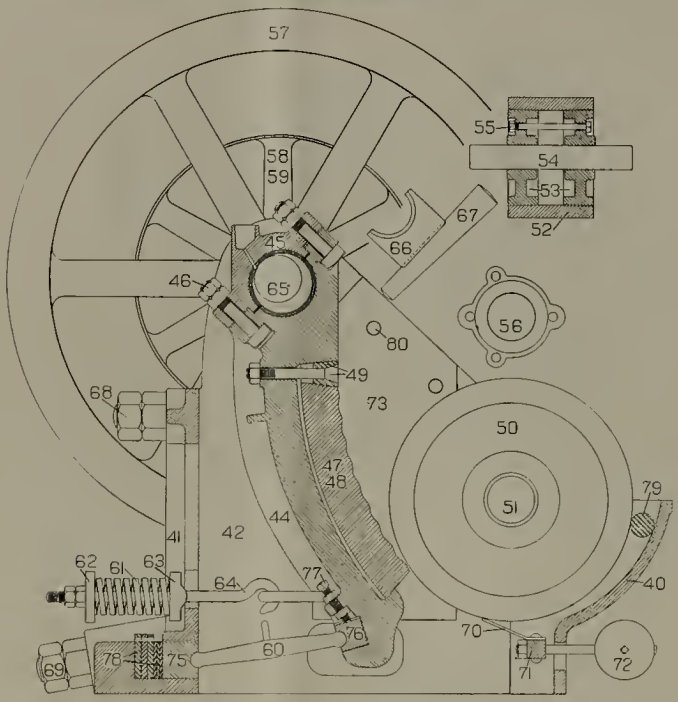

## Specifications for Roller Jaw Crushers

| No. | Size of Jaw Opening Inches | Driving Pulleys | | | Capacity per Hour in Tons | H. P. Required | Weight of Heaviest Piece | Total Weight | Dimensions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Inches | | Rev. per Minute | | | | | Length | Width | Height |
| | | Diam. | Face | | | | POUNDS | POUNDS | | | |
| 2 | 6 x 12 | 22 | 6 | 250 | 3 | 6 | 430 | 4415 | 4′ 2″ | 4′ 9″ | 4′ 3″ |
| 3 | 7 x 14 | 24 | 8 | 225 | 5 | 9 | 600 | 6000 | 4′ 8″ | 5′ 1″ | 4′ 9″ |
| 4 | 9 x 24 | 36 | 10 | 225 | 8 | 12 | 1465 | 12700 | 5′ 6″ | 5′ 8″ | 5′ 4″ |


## Specifications for Sectional Roller Jaw Crushers

| Type | No. | Size of Jaw Opening Inches | Driving Pulleys | | | Capacity per Hour in Tons | H. P. Required | Weight of Heaviest Piece | Total Weight | Dimensions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inches | | Rev. per Minute | | | | | Length | Width | Height |
| | | | Diam | Face | | | | POUNDS | POUNDS | | | |
| Eburum. | 2 | 6 x 12 | 22″ | 6½″ | 250 | 3 | 6 | 300 | 4850 | 4′ 2″ | 4′ 9″ | 4′ 3″ |
| Eboule | 3 | 7 x 14 | 24″ | 8½″ | 225 | 5 | 9 | 350 | 6635 | 4′ 8″ | 5′ 1″ | 4′ 9″ |

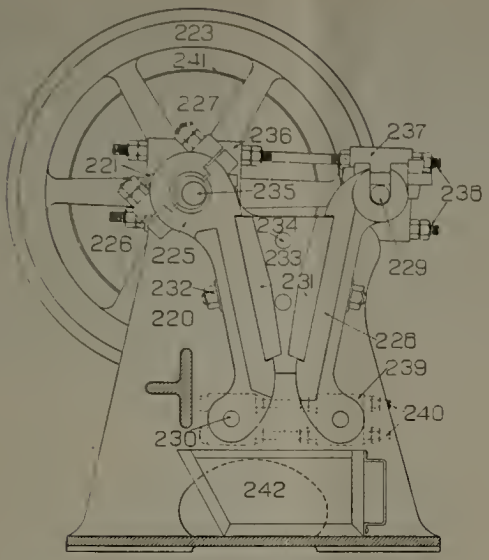
The heaviest pieces are on the No. 3, viz.: { 2 Frame Sections 350 lbs. each; 1 Front End, 340 lbs. each; 1 Back End, 325 lbs. each }




## Key for Ordering Renewals for Roller Jaw Crusher

40. Front end frame.
41. Back end frame.
42. Side frame, right hand.
43. Side frame, left hand.
44. Swinging jaw.
45. Cap for swinging jaw.
46. Bolts for cap for swinging jaw.
47. Cast iron shoe for swinging jaw.
48. Cast steel shoe for swinging jaw.
49. Wedge and bolt for shoe.
50. Cast iron roller.
51. Cast iron roller shaft.
52. Cast steel roller shell.
53. Cast steel roller shell centers.
54. Cast steel roller shell shaft.
55. Cast steel roller shell bolts.
56. Roller shaft bushing.
57. Flywheel.
58. Tight pulley.
59. Loose pulley.
60. Toggle (give size required).
61. Spring.
62. Cap for spring.
63. Washer for spring.
64. Hook rod for spring.
65. Eccentric shaft.
66. Eccentric shaft bearing block.
67. Key for shaft bearing block.
68. Upper frame tie rods.
69. Lower frame tie rods.
70. Scraper plate.
71. Scraper shaft.
72. Scraper weight and rod.
73. Side plate, right hand.
74. Side plate, left hand.
75. Back end frame toggle seat.
76. Swing jaw toggle seat.
77. Swing jaw toggle seat bolt.
78. Filling plates.
79. Roller locking bar.
80. Bolt for side plates.

For the sectional crusher, the flywheel (57), the right-hand side frame (42), the left-hand side frames (43), swinging jaw (44), and the cast iron roll (50) are made sectional.




## Key for Ordering Renewals for Hutchinson Crusher

No.

220. Frame.
221. Cap for frame.
222. Stud bolts for cap frame.
223. Flywheel.
224. Handle and bolt for flywheel.
225. Rolling jaw.
226. Cap for rolling jaw.
227. Stud bolts for cap for rolling jaw.
228. Swinging jaw.
229. Shaft for swinging jaw and upper link block.
230. Lower link block pins.
231. Dies.
232. Bolt for dies.
233. Side plates.
234. Bolts for side plates.
235. Eccentric shaft.
236. Eccentric shaft head on upper link.
237. Swinging jaw head on upper link.
238. Rods for upper link.
239. Heads on lower link.
240. Rods for lower link.
241. Pulleys.
242. Pan.

## The "Hutchinson" Ore Crusher

The Hutchinson Ore Crusher, while designed primarily as a fine breaker is also adapted for fairly heavy work, and may be used as a primary breaker in capacities up to 15 tons per hour. Its particular function, however, is fine crushing, and in this respect is unequalled by any other breaker. The character of the movement is unusual in that there is no stationary jaw. Both jaws move simultaneously in such a way as to give a combined crushing and grinding movement that speedily reduces the rock to the desired fineness.

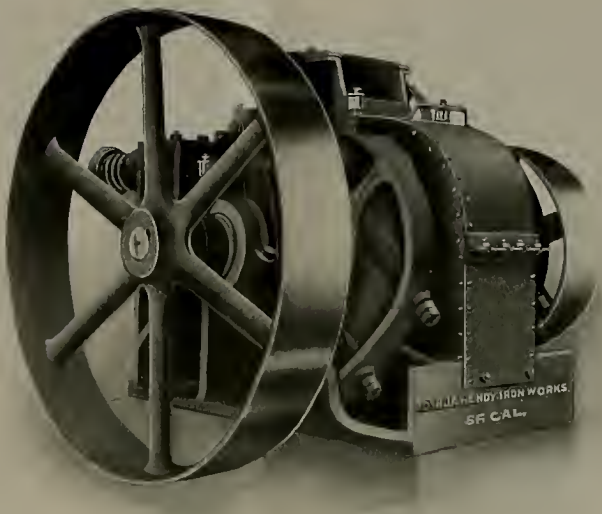
The crank shaft has a two-throw eccentric, and the jaws are yoked together by adjustable connecting rods. The movement is such that the jaws approach one another and then recede, and at the same time the back jaw has a slight upward and downward movement, giving a crushing and grinding action on the particles of rock and also crowds the product downward until it has finally been reduced to the required fineness and is discharged.

As will be observed in the illustration, this breaker is quite proportionately and compactly designed. Adjustment of the size of discharge opening and also the necessary adjustments for compensating the wear are readily made by shortening up the connecting rods. This is accomplished by screwing up the nuts and tightening the lock-nuts on the rods provided for that purpose. The wearing shoe and die are reversible, end for end, in order that a maximum wear may be obtained before renewals are necessary. This breaker is particularly adapted for primary breaking preparatory to feeding into Cornish rolls, or centrifugal or roller mills, etc., where a fine feed is most essential for satisfactory fine crushing; and as a secondary breaker following the Hercules-Blake or other primary breaker where stage crushing is employed.

The smallest size Hutchinson Breaker as appears in the illustration on page 18 was especially designed for laboratory or assay office work, and the drill bolts on the upper end of the reciprocating jaw may be removed, allowing the entire jaw to swing outward and thereby providing an easy access to the crushing opening of the breaker for cleaning purposes, which is essential to prevent the salting of samples

## Specifications for Hutchinson Crusher

| Size of Machine | No. | Size of Ex. Opening | Pulleys | | | Capacity per Hour Crushing to 1" Size | H. P. Required | Weight of Heaviest Piece | Total Weight | Dimensions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Inches | | Rev. per Minute | | | Pounds | Pounds | Length | Width | Height |
| | | | Diam. | Face | | | | | | | | |
| Brass | 1 | 4" x 4" | 16" | 3½" | 225 | 1 | 3 | 225 | 790 | 1' 4" | 2' 6" | 3' 0" |
| Brum | 2 | 7" x 9" | 22" | 6½" | 200 | 3 | 6 | 500 | 3000 | 3' 0 | 3' 6" | 3' 6" |
| Hoofer | 3 | 8½" x 12" | 24" | 8½" | 175 | 6 | 9 | 850 | 4500 | 4' 2 | 4' 9" | 4' 0 |

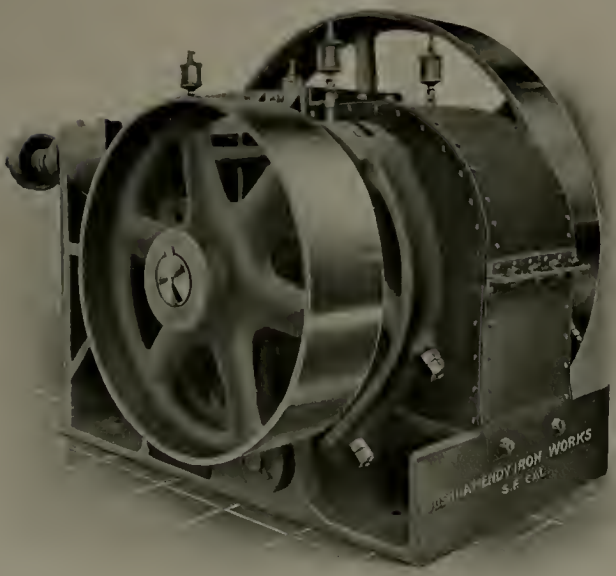



## Standard (Class A) Crushing Rolls

The above illustration is of our Standard (Class "A") Crushing Roll, and we can refer to many that, have been in continuous operation for ten years without any expense for renewals other than roll shells.

The journal boxes are of the ball and socket type, in order that the strains on the bearings may be equalized. The adjustable roll is carried on two swinging arms or journals pivoted at the bottom. Secured to the top ends of each of these arms is a heavy tension rod which is carried through the opposite end of the frame. These rods are made with an eye on the front end, the back end being made with thread and double lock nuts for adjusting. The roll shafts have keyed onto them the cast iron centers for the shells and which are carefully turned to a taper. The shells are made of chrome steel turned true on the face and bored on the inside to corresponding taper of shell centers, and held in place by bolts. These are completely encased in a sheet iron housing and a cast iron feed hopper fits between rolls fitted with wearing plates. When required, an automatic swinging gate feeder may be supplied. The rigid roll is the main driver, and is fitted with the larger sized pulley, while the adjustable roll shaft is fitted with a smaller pulley.

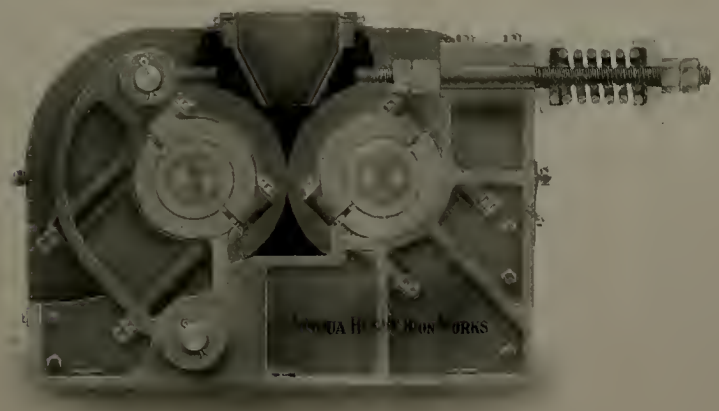
The capacity depends upon the speed and size to which the ore is to be crushed. These rolls are specially adapted for use in coarse concentration where coarse crushing may be adapted best for the cyanide or other methods.

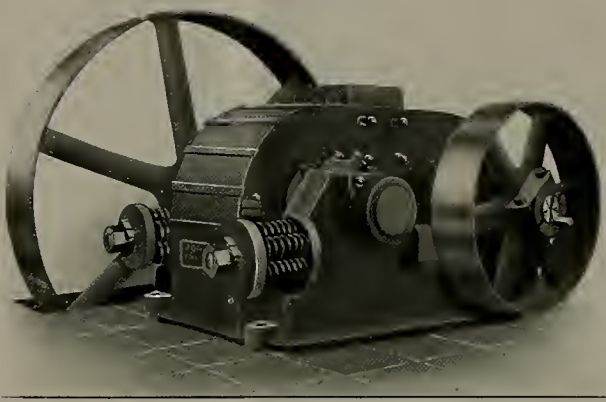



## Standard (Class A) Crushing Rolls Showing Feeder Removed

## Specifications

| Code Word | No | Size of Rolls Dia. | Size of Rolls Width | Size of Rigid Roll Pulley Inches | Size of Adjustable Roll Pulley Inches | Weight of Heaviest Piece Pounds | Total Shipping Weight Pounds | Weight of Feeder Extra Pounds | Capacity in Tons per hour 16 to 4 Mesh | Rev. per Minute | H. P. Required | Extreme Dimensions Leng'h | Width | Heig't |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ebur. | 1 | 20 | 8 | 60 x 8 | 30 x 6 | 1015 | 6700 | 175 | 1 to 5 | 100–150 | 3 to 6 | 5′ 8″ | 4′ 0″ | 4′ 4″ |
| Idax. | 2 | 20 | 12 | 60 x 10 | 30 x 8 | 1050 | 7100 | 175 | 1½ to 6 | 100–150 | 4 to 8 | 5′ 8″ | 4′ 8″ | 4′ 4″ |





## Standard (Class B) Crushing Rolls

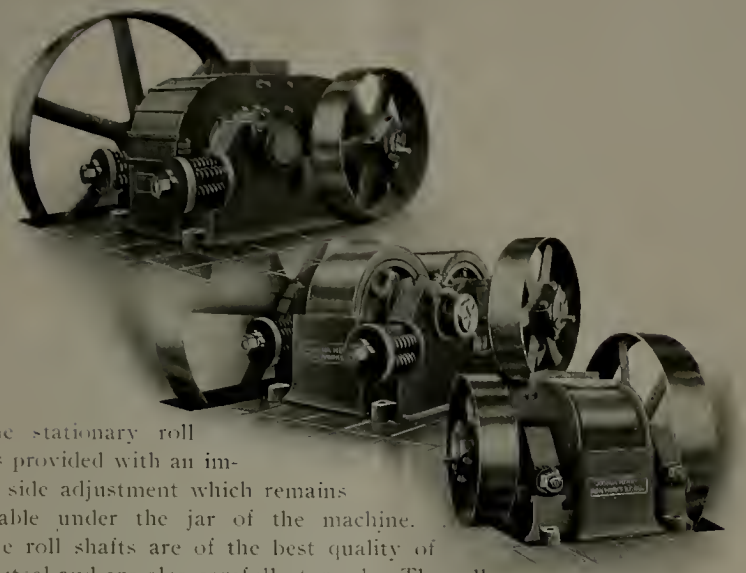
The experience gained by many years in the production of high grade mining and milling machinery and a close observation of the actual performance of our machines under stress of varying loads and adverse conditions have enabled us to discover mechanical limitations and gradually evolve a combination of strength, compactness and durability with maximum output.

The STANDARD (Class "B") CRUSHING ROLLS, which embody all the principles known to be correct for its type, together with the improvement which persistent investigation has proven most desirable, is unquestionably superior to any crushing rolls we have yet produced.

In the description following, the engineer or practical millman will readily appreciate the exclusive features incorporated in the design of these rolls and recognize the ease with which running repairs and substitution may be made.

The main frame is of heavy proportion, made in a single piece and designed with a view to absolute rigidity, the bearings of the stationary roll being cast as a part of the same piece. The base is planed to facilitate installation. The bearings or journals are of liberal dimension and provided with a thick lining of the best babbit metal.

Special provision has been made for adjustment, both longitudinal and lateral, thus eliminating any unnecessary strain. The movable bearings are constructed and set in their supporting castings so that the roll shaft may accommodate itself to the accidental passage of an unusually hard substance, through either edge of the roll without subjecting the machine to a one-sided strain and a resulting serious injury.



The stationary roll shaft is provided with an improved side adjustment which remains immovable under the jar of the machine.

The roll shafts are of the best quality of forged steel and are also carefully turned. The roll shells are made of "Adamantine" Chrome Steel, turned true on the face, bored out tapering to fit the roll centers and held in place by heavy draw bolts.

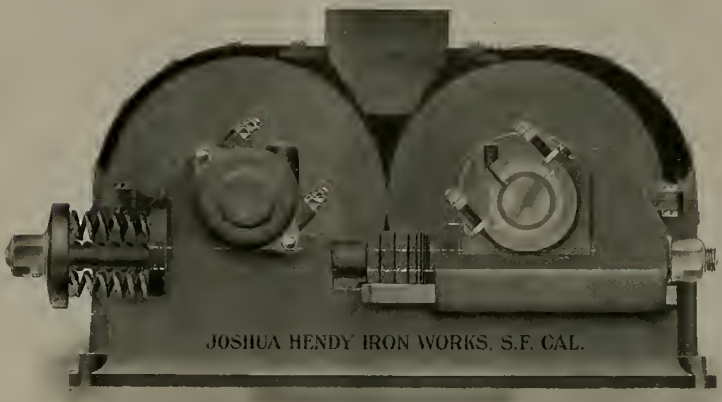
Each set of rolls is provided with one large pulley on the stationary roll shaft and one small pulley on the movable shaft. The pulleys are made with clamp hubs and are additionally fitted with a key, thus insuring a most rigid attachment, though easily removed for repair.

The average resistance to crushing is probably less than 5,000 pounds pressure. This pressure is purely variable and will rise much higher than the above figure or fall to nil, according to rate and size of feed.

An even pressure is sustained by two main tension bolts provided with eight helical springs, whose limit of compression is ascertained by actual hydrostatic pressure. The springs yield only when the resistance to crushing reaches their limit of compression. Between the faces of the movable bearings and the collars of the tension rods are interposed removable shims of varying thickness, by means of which, with the desired amount of compression on the springs, the distance between the roll faces may be maintained at a fixed minimum, and the rolls never come together, even when running without feed.

The tension rod nuts are of the special clamp type and will not jar loose. The upper housing for the rolls is made of cast iron to fit the lower housing. These cast iron sides are finished on the bottom, to make an accurate joint

with the frame. The remaining section over the rolls is provided with a flexible heavy duck or canvas cover having heavy wooden strips to hold it in place. On the top of the housing there is placed centrally a cast iron receiving hopper, through which the material is fed to the rolls.

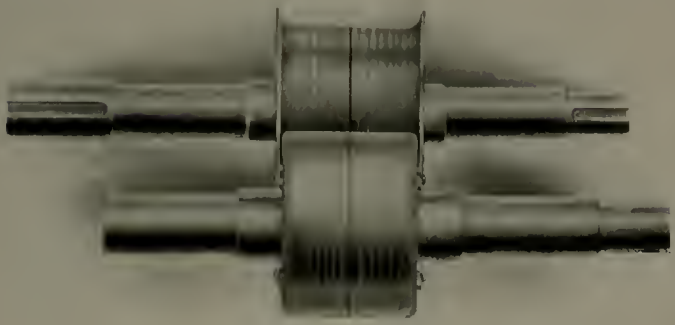



Cross Section Through Class B Rolls

## Specifications

| Code Word | No. | Size of Rolls Dia. Inches | Width Inches | Size of Rigid Roll Pulley Inches | Size of Adjustable Roll Pulley Inches | Weight of Heaviest Piece Pounds | Total Shipping Weight Pounds | Weight of Feeder Extra Pounds | Capacity in Tons per hour 16 to 4 Mesh | Rev. per Minute | H. P. Required | Extreme Dimensions Leng'h | Width | Heig't |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Edent | 3 | 27 x 12 | | 60 x 12 | 30 x 8 | 2200 | 12,000 | 175 | 2 to 7 | 75 to 125 | 5 to 10 | 6′ 5″ | 5′ 3″ | 4′ 0″ |
| Edible | 4 | 30 x 14 | | 72 x 12 | 36 x 8 | 2500 | 14,000 | 175 | 2½ to 8 | 65 to 85 | 8 to 15 | 7′ 3″ | 5′ 7″ | 4′ 8″ |
| Edin.. | 5 | 36 x 16 | | 84 x 16 | 42 x 10 | 7000 | 24,000 | 175 | 3 to 9 | 50 to 75 | 10 to 20 | 9′ 0″ | 6′ 8″ | 6′ 2″ |

# Flanged Roll Shells



The above is an illustration of a pair of flanged roll shells designed and used by the Lassen Mining Company at Haydenhill, Cal.

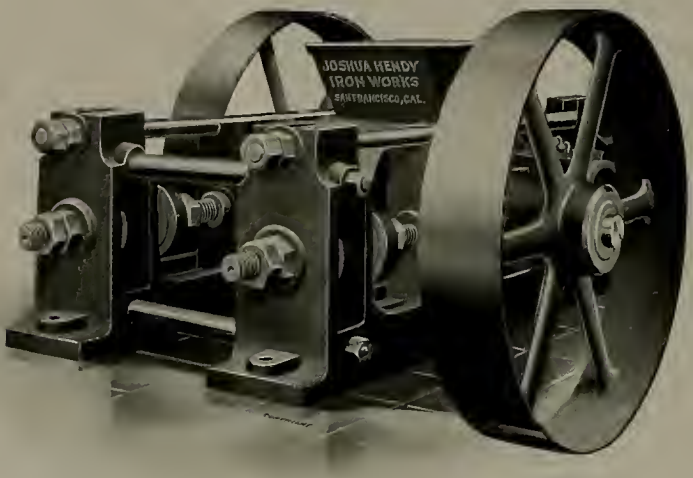
This particular type of flanged shell has been in successful operation at the above mine for several years, and the addition of the flanges has increased the life of the shell fifty per cent. One set of these flanged shells, made of Manganese steel, has crushed 30,000 tons of ore to a 10 mesh, whereas the ordinary type of shell—without the flanges—would not crush more than 15,000 tons before it became necessary to replace them.

The corrugation of roll shells, largely caused by side thrust of the floating shaft, has been practically overcome by the use of a double flanged shell on the driven roll.

On certain types of crushing rolls this side thrust has been so great that before the shell had performed half its work, only sixty per cent of the face of the shell was in use—the side thrust and corrugations causing a flange to form on one side of the shell, making the crushing surface uneven, and leaving the shell in the form of a flanged car wheel.

By using a double flanged shell on the floating shaft, as shown in the accompanying illustration, the side thrust has been entirely eliminated, the shells wear even and true and the corrugations are reduced to a minimum.

Shells of this type that have been in constant use for six years have increased the efficiency of the crushing rolls fifty per cent since their adoption.

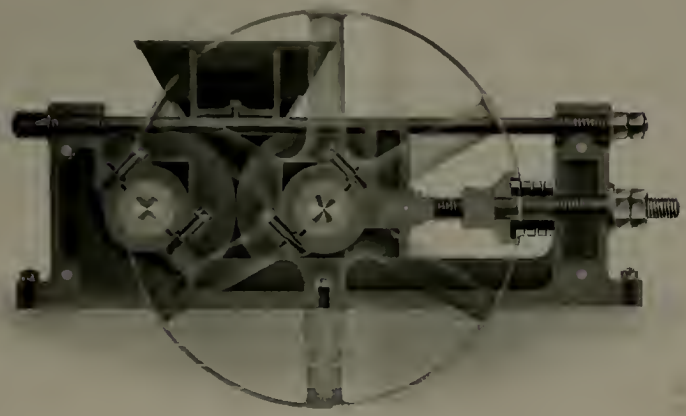



## "Special" Re-Crushing Rolls

Here is illustrated what we have termed our special design of re-crushing rolls; these are of lighter design and construction, to be used where the duty is not as severe as where the "Standard" are employed. Several are in use for disintegrating dried tailings, preparatory to treatment by the cyanide process or where a limited amount of ore is to be crushed very fine, as in sampling works. The roll faces are generally turned and ground to give a perfect contact between them.

The general construction is as shown by cut and consists of two side frames, tied together cross-wise by through bolts and thimbles, and the upper side lengthwise with through bolts. The rigid roll is supported by bearings, the lower half of which is cast with frames. The movable roll is supported by bearings fitted to a guide in bottom of frames and adjusted by means of heavy screws and lock nuts and springs, for adjusting it to such size of crushing as may be desired, and to relieve any undue pressure upon rolls. A cast iron feed hopper is placed between rolls.

The roll centers and shafts are cast together, the center being turned to a taper and the cast steel shells are bored to fit same and secured by cross-bolts. With these, both rolls are fitted with the same diameter and face of driving pulleys, and are not fitted with sheet iron housing.

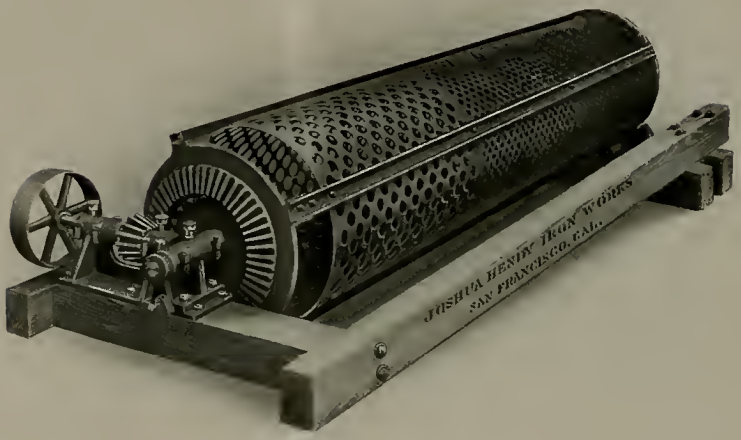


Cross-Section Through "Special" Re-Crushing Rolls

## Specifications

| [illegible] | Size of Driving Pulleys | Weight of Heaviest Piece | Total Weight | Capacity in Tons Per Hour 4 to 40 Mesh | Revolutions | Horse-Power Required | Extreme Dimensions | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Length | Width | Height above Base |
| 10 | 10 × 10 | 36 × 8 | 550 | 3400 | 1 ½—2 | 150–200 | 3 to 6 | 5′ 8″ | 4′ 1″ | 2′ 3″ |

[illegible] Word
- Edisma . Fitted with steel shells turned on face.
- Editus . Fitted with chilled iron shells ground on face.
- Edolat . Fitted with chilled iron shells not ground on face.




## Revolving Rock Screen or Trommel

This type of construction embodies the latest ideas and improvements on this class of machinery and is the most satisfactory design that can be employed for the purpose. The feed end is fitted with a cast iron throat on which a tire is mounted, which revolves in two rollers. The feed throat extends far enough beyond the rollers to prevent the dust from getting into the roller bearings. The discharge end of the screen, as will be seen in the illustration, is free from obstruction, the driving mechanism being located at this end, the gear being cast on a cast iron plate, and this plate being the same diameter as the screen itself.

The driving gear is fastened to the screen with four pieces of heavy channel steel extending throughout the entire length of the screen and securely bolted to same. The driving mechanism extends beyond the point of screen discharge and is fully protected against grit or dust.

The screen may be fitted with or without right angle drive, to suit individual requirements.

The screen proper is made of steel plate with holes punched or drilled to suit conditions of purchasers.

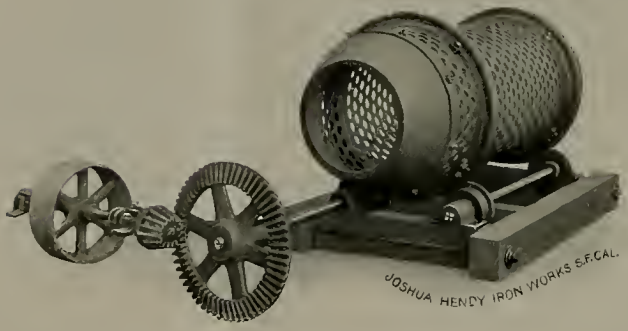
# Specifications and Weights of

# Heavy Trunnion Revolving Screens

Size of holes to be specified, one size hole for each section. If screens are required with holes punched of a diameter less than ¾ inch, additional charge must be allowed for such diversion.

NOTE.—Two sizes of holes give three grades of product, three sizes of holes give four grades.

| Code Word | No. | Diam. of Screen Inches | No. of Sections | Thickness of Plate Inches | Length of Screen Feet | Rev. of Screen per Minute | Rev. of Pulley per Minute | Size of Pulley Inches | Weight of Iron Work only Pounds | Weight of Wood Frame Pounds |
|---|---|---|---|---|---|---|---|---|---|---|
| Edusa | 740 | 24 | 2 | 1/4 | 6 | 22 1/2 | 45 | 24 x 6 | 1550 | 350 |
| Eduleat | 741 | 24 | 2 | 1/4 | 8 | 22 1/2 | 45 | 24 x 6 | 1675 | 375 |
| Eduros | 742 | 24 | 2 or 3 | 1/4 | 10 | 22 1/2 | 45 | 24 x 6 | 1800 | 400 |
| Edusa | 743 | 30 | 2 | 1/4 | 8 | 22 | 44 | 30 x 6 | 2375 | 450 |
| Efedra | 744 | 30 | 2 or 3 | 1/4 | 10 | 22 | 44 | 30 x 6 | 2575 | 475 |
| Effels | 745 | 30 | 3 or 4 | 1/4 | 12 | 22 | 44 | 30 x 6 | 2775 | 500 |
| Egala | 746 | 36 | 2 or 3 | 1/16 | 10 | 20 | 45 | 36 x 6 | 3525 | 550 |
| Edges | 747 | 36 | 2 or 3 | 1/16 | 12 | 20 | 45 | 36 x 6 | 3825 | 575 |
| Egulo | 748 | 36 | 4 | 1/16 | 14 | 20 | 45 | 36 x 6 | 4125 | 600 |
| Egis | 749 | 42 | 3 or 4 | 1/16 | 12 | 18 | 45 | 36 x 8 | 4800 | 700 |
| Egout | 750 | 42 | 4 | 1/16 | 14 | 18 | 45 | 36 x 8 | 5150 | 725 |
| Egula | 751 | 42 | 4 | 1/16 | 16 | 18 | 45 | 36 x 8 | 5500 | 750 |
| Ejertas | 752 | 48 | 4 | 1/8 | 14 | 16 | 48 | 42 x 8 | 6790 | 850 |
| Ejulat | 753 | 48 | 4 | 1/8 | 16 | 16 | 48 | 42 x 8 | 7215 | 875 |
| Ekel | 754 | 48 | 4 | 1/8 | 18 | 16 | 48 | 42 x 8 | 7640 | 900 |




Revolving Rock Screen or Trommel (Roller Type)

The above illustration shows our revolving screen, which has been designed to meet the requirements of those desiring a cheaper type of screen than the Trunnion type on page 28.

This screen is of the roller type, screen being fitted with two tires and is supported and driven by four rollers as shown. The screen is fitted with cast iron feed throat, the oversize discharged at the opposite end.

Screen proper may be made of any required thickness and punched with holes of any size to suit individual requirements. This screen may be furnished with or without right angle drive, as desired.

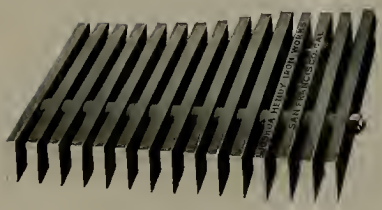
# Specifications and Weights of Roller Type Revolving Screens

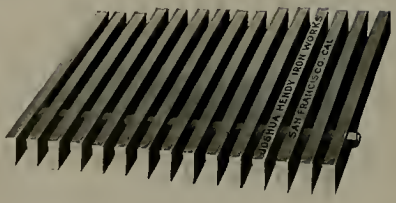
Size of holes to be specified, one size hole for each section. If screens are required with holes punched of a diameter less than ¾ inch, additional charge must be allowed for such diversion.

NOTE.—Two sizes of holes give three grades of product, three sizes of holes give four grades.

| Our No. | Diam. of Screen Inches | No. of Sections | Thickness of Plate Inches | Length of Screen Feet | Rev. of Screen per Minute | Rev. of Pulley per Minute | Size of Pulley Inches | Weight of Iron Work only Pounds | Weight of Wood Frame Pounds |
|---|---|---|---|---|---|---|---|---|---|
| Elami 760 | 24 | 2 | 3/16 | 6 | 22½ | 45 | 24 x 6 | 1525 | 350 |
| Eland 761 | 24 | 2 | 1/4 | 8 | 22½ | 45 | 24 x 6 | 1645 | 375 |
| Elano 762 | 24 | 2 or 3 | | 10 | 22½ | 45 | 24 x 6 | 1745 | 400 |
| Elara 763 | 30 | 2 | 1/4 | 8 | 22 | 44 | 30 x 6 | 1980 | 450 |
| Elding 764 | 30 | 2 or 3 | 1/4 | 10 | 22 | 44 | 30 x 6 | 2125 | 475 |
| Elenco 765 | 30 | 3 or 4 | 1/4 | 12 | 22 | 44 | 30 x 6 | 2270 | 500 |
| Eleum 766 | 36 | 2 or 3 | 5/16 | 10 | 20 | 45 | 36 x 6 | 2910 | 550 |
| Elevans 767 | 36 | 2 or 3 | 5/16 | 12 | 20 | 45 | 36 x 6 | 3130 | 575 |
| Elfin 768 | 36 | 4 | 5/16 | 14 | 20 | 45 | 36 x 6 | 3350 | 600 |
| Elgin 769 | 42 | 3 or 4 | 5/16 | 12 | 18 | 45 | 36 x 8 | 3950 | 700 |
| Elida 770 | 42 | 4 | 5/16 | 14 | 18 | 45 | 36 x 8 | 4200 | 725 |
| Elimo 771 | 42 | 4 | 5/16 | 16 | 18 | 45 | 36 x 8 | 4455 | 750 |
| Elisma 772 | 48 | 4 | 3/8 | 14 | 16 | 48 | 42 x 8 | 5570 | 850 |
| Elpis 773 | 48 | 4 | 3/8 | 16 | 16 | 48 | 42 x 8 | 5925 | 875 |
| Eludia 774 | 48 | 4 | 3/8 | 18 | 16 | 48 | 42 x 8 | 6280 | 900 |

NOTE.—If screens are ordered with holes punched less than ¾ inch, an additional charge will be made.




# Ore Grizzlies

| Code Word | No. | Size in Inches | | Clear Space Inches between Top of Bars | Number of Bars | Size of Bars Inches | Number of Cross Rods | Weight Pounds |
|---|---|---|---|---|---|---|---|---|
| | | Width | Length | | | | | |
| **Standard Parallel Bar Grizzlies** | | | | | | | | |
| Elyrus | 1 | 35½ | 96 | 2 | 15 | ½ x 2½ | 3 | 550 |
| Emanat | 2 | 36½ | 96 | 1¾ | 17 | ½ x 2½ | 3 | 620 |
| Emax | 3 | 36½ | 96 | 1½ | 19 | ½ x 2½ | 3 | 690 |
| Embada | 4 | 37⅛ | 96 | 2 | 15 | ⅝ x 3 | 3 | 800 |
| Embair | 5 | 36¼ | 96 | 1¾ | 16 | ⅝ x 3 | 3 | 855 |
| Embala | 6 | 36¾ | 96 | 1½ | 18 | ⅝ x 3 | 3 | 960 |
| Embank | 7 | 47⅜ | 120 | 2 | 19 | ⅝ x 3 | 3 | 1260 |
| Embar | 8 | 48⅛ | 120 | 1¾ | 21 | ⅝ x 3 | 3 | 1400 |
| Embid | 9 | 47⅛ | 120 | 1½ | 23 | ⅝ x 3 | 3 | 1520 |
| Emen | 10 | 47⅞ | 144 | 2 | 19 | ⅝ x 3 | 4 | 1530 |
| Emerat | 11 | 48⅛ | 144 | 1¾ | 21 | ⅝ x 3 | 4 | 1675 |
| Engis | 12 | 47⅛ | 144 | 1½ | 23 | ⅝ x 3 | 4 | 1830 |
| **Standard Light Taper Bar Grizzlies** | | | | | | | | |
| Engos | 789 | 36⅛ | 96 | ½ | 33 | ½ x ⅜ x 2½ | 3 | 1242 |
| Engst | 790 | 36⅛ | 96 | ¼ | 27 | ⅝ x ⅜ x 2½ | 3 | 1030 |
| Emetin | 791 | 36⅛ | 96 | 1 | 23 | ⅝ x ⅜ x 2½ | 3 | 925 |
| Emina | 792 | 36¼ | 96 | 1¼ | 20 | ⅝ x ⅜ x 2½ | 3 | 795 |
| Enchant | 793 | 36¼ | 96 | 1½ | 18 | ⅝ x ⅜ x 2½ | 3 | 713 |
| Enclos | 794 | 37⅛ | 96 | 2 | 15 | ⅝ x ⅜ x 2½ | 3 | 614 |
| Encono | 795 | 36⅛ | 120 | ½ | 33 | ⅝ x ⅜ x 2½ | 4 | 1530 |
| Endexa | 796 | 36⅛ | 120 | ¼ | 27 | ⅝ x ⅜ x 2½ | 4 | 1280 |
| Endict | 797 | 36⅛ | 120 | 1 | 23 | ⅝ x ⅜ x 2½ | 4 | 1115 |
| Enlos | 798 | 36¼ | 120 | 1¼ | 20 | ⅝ x ⅜ x 2½ | 4 | 990 |
| Endono | 799 | 36¾ | 120 | 1½ | 18 | ⅝ x ⅜ x 2½ | 4 | 910 |
| Endtag | 800 | 37⅛ | 120 | 2 | 15 | ⅝ x ⅜ x 2½ | 4 | 775 |
| **Standard Heavy Taper Bar Grizzlies** | | | | | | | | |
| Enduro | 808 | 36½ | 96 | 2 | 14 | ¾ x ⅜ x 3 | 3 | 715 |
| Enfado | 809 | 35¾ | 96 | 1¾ | 15 | ¾ x ⅜ x 3 | 3 | 765 |
| Enfant | 810 | 36¾ | 96 | 1½ | 17 | ¾ x ⅜ x 3 | 3 | 860 |
| Enfen | 811 | 47½ | 120 | 2 | 18 | ¾ x ⅜ x 3 | 3 | 1125 |
| Enform | 812 | 48¼ | 120 | 1¼ | 20 | ¾ x ⅜ x 3 | 3 | 1250 |
| Enfui | 813 | 48 | 120 | 1½ | 22 | ¾ x ⅜ x 3 | 3 | 1375 |
| Engra | 814 | 48¾ | 120 | 1¼ | 25 | ¾ x ⅜ x 3 | 3 | 1560 |
| Enops | 815 | 48 | 120 | 1 | 28 | ¾ x ⅜ x 3 | 3 | 1745 |
| Enoto | 816 | 47½ | 144 | 2 | 18 | ¾ x ⅜ x 3 | 4 | 1300 |
| Enovat | 817 | 48¼ | 144 | 1¼ | 20 | ¾ x ⅜ x 3 | 4 | 1570 |
| Enow | 818 | 48 | 144 | 1½ | 22 | ¾ x ⅜ x 3 | 4 | 1660 |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